

<u>Pay Item</u>	<u>Pay Unit</u>
527.34 Work Zone Crash Cushions	Unit

SECTION 528 - STRUCTURAL TIMBER

Reserved

SECTION 529 - NAVIGATIONAL AIDS

Reserved

SECTIONS 531 to 533 - VACANT

SECTION 534 - PRECAST STRUCTURAL CONCRETE

Reserved

SECTION 535 - PRECAST, PRESTRESSED CONCRETE SUPERSTRUCTURE

535.01 Description This work shall consist of casting and erecting precast and prestressed concrete products and related material. Materials, work, inspection and documentation not specifically addressed by this Specification shall be done in accordance with the applicable sections of the Precast/Prestressed Concrete Institute (PCI), *Manual for QUALITY CONTROL for Plants and Production of PRECAST AND PRESTRESSED CONCRETE PRODUCTS* (MNL 116), including Commentary.

535.02 Materials. Materials for precast and prestressed concrete products shall meet the requirements of the following

Sections:

Water	701.02
Air Entraining Admixture	701.03
Water Reducing Admixture	701.04
High Range Water Reducing Admixture (HRWR)	701.0401
Set-Retarding Admixtures	701.05
Fly Ash	701.10
Calcium Nitrite Solution	701.11
Silica Fume	701.12
Ground Granulated Blast Furnace Slag	701.13
Fine Aggregate for Concrete	703.01
Coarse Aggregate for Concrete	703.02
Reinforcing Steel	709.01
Welded Steel Wire Fabric	709.02
Steel Strand for Concrete Reinforcement	709.03

Portland cement shall conform to the requirements of AASHTO M85 (ASTM C150), Type I, Type II, or Type III. The Contractor shall supply the Department with copies of certified mill tests of the cement. The mill tests shall show the name of the manufacturer, location where produced, silo number and the person or agency conducting the test.

Coarse aggregate shall conform to the requirements of Section 703.02 - Coarse Aggregate for Concrete, Class A, Class AA or Latex.

A Materials Certification from the manufacturer of the steel pre-stressing strand shall be provided to the Fabrication Engineer. The certification shall include a representative load elongation curve for each coil. Each coil of strand shall be clearly identified by the manufacturer and the identification shall not be removed from the coil until it is entirely used. Partial coils may be used only with the approval of the Fabrication Engineer. Failure to maintain trace-ability of a coil will be cause for rejection.

535.03. Drawings The Contractor shall prepare shop detail, erection and other necessary working drawings in accordance with Section 105.7 - Working Drawings. The drawings will be reviewed and approved in accordance with the applicable requirements of Section 105.7. Changes and revisions to the approved working drawings shall require further approval by

the Fabrication Engineer.

Concrete mix designs shall be part of the shop drawing submittal. Mix designs shall include aggregate specific gravity, absorption, percent fracture, fineness modulus and gradation.

A copy of the Contractor's Quality System Manual (Q.S.M.) shall be submitted when requested by the Fabrication Engineer.

535.04 Plant Precast, prestressed concrete products shall be manufactured in a Precast/Pre-stressed Concrete Institute (PCI) Certified facility.

535.05 Inspection Facilities The Contractor shall provide a private office at the fabrication plant for inspection personnel authorized by the Department. The office shall have an area not less than 9.3 m² [100 ft²] and shall be in close proximity to the work. The office shall be climate controlled to maintain the temperature between 18°C [65°F] and 30°C [85°F], lighted and have the exit(s) closed by a door(s) equipped with a lock and 2 keys which shall be furnished to the Inspector(s). The office shall be equipped with a desk or table having a minimum size of 1200 mm by 760 mm [48 in by 30 in], 2 chairs, a telephone, telephone answering machine, line data port, plan rack and 2-drawer letter size file cabinet with a lock and 2 keys which shall be furnished to the Inspector(s).

The facilities and all furnishings shall remain the property of the Contractor upon completion of the work. Payment for the facilities, heating, lighting, telephone installation, basic monthly telephone charges and all furnishings shall be incidental to the contract.

535.06 Notice of Beginning Work The Contractor shall give the Fabrication Engineer a minimum of two weeks notice prior to beginning work. The Contractor shall advise the Fabrication Engineer of the production schedule and any changes to it. If the Contractor suspends work on a project, the Fabrication Engineer will require 48 hours notice prior to the resumption of work.

535.07 Inspection Quality Control (Q.C.) is the responsibility of the Contractor. Quality Control Inspectors (QCIs) shall have a valid PCI Quality Control Certification Level I, Level II or Level III. Personnel performing concrete testing shall hold a current ACI Field Testing Technician Grade I Certification or equivalent, or work under the direct supervision of an ACI certified technician.

The QCI shall inspect all aspects of the work in accordance with the Contractor's QSM. The QCI shall record measurements and test results on the appropriate forms from APPENDIX E of MNL 116 or an equivalent form prepared by the user. Copies of measurements and test results shall be provided to the Quality Assurance Inspector (QAI) as follows:

Type of Report	When Provided to Q.A.I*
Material certifications/stressing calculations/calibration certifications	Prior to beginning work (anticipate adequate time for review by QAI)
Tensioning report	The same work day
Pre-pour inspection report	Prior to the concrete placement
Concrete Batch Slips	The morning of the next work day
Results of concrete testing	The morning of the next work day
Results of compressive testing (for release)	The same work day
Concrete temperature records	Provide with compressive testing (for release)
Non-conformance reports/repair procedures	Within 24 hours of discovery
Results of compressive testing (for design strength)	Prior to stopping curing/Prior to final acceptance
Post-pour inspection report	Prior to final acceptance

*The Contractor and QAI, by mutual agreement, may modify any part of the schedule, however, failure to provide the documentation when required will result in the product being deemed unacceptable.

The QCI shall reject materials and workmanship that do not meet contract requirements. The Contractor may perform testing in addition to the minimum required. The results of all testing shall be made available to the (QAI).

Quality Assurance (Q.A.) is the prerogative of the Fabrication Engineer. The QAI will verify documentation, periodically inspect workmanship, and witness testing. Testing deemed necessary by the Fabrication Engineer in addition to the minimum testing requirements shall be scheduled to minimize interference with the production schedule.

535.08 Inspector's Authority The QAI will have the authority to reject material or workmanship that does not meet the contract requirements. The acceptance of material or workmanship by the QAI will not prevent subsequent rejection, if

found unacceptable.

535.09 Rejections Rejected material and workmanship shall be corrected or replaced by the Contractor. In the event that an item fabricated under this Specification does not meet the contract requirements but is deemed suitable for use by the Fabrication Engineer, said item will be paid for in accordance with Section 108.8.1 - Substantially Conforming Work.

535.10 Forms and Casting Beds Form dimensions shall conform to the approved shop drawings. Forms shall be well constructed, carefully aligned and sufficiently tight to prevent leakage of mortar. Forms that do not maintain the plan dimensions within allowable tolerances during concrete placement shall be rejected.

Bulkheads shall be fabricated and secured in a manner that prevents leakage of mortar. Bulkheads between units shall be separated by a minimum of 450 mm [18 in]. Bulkheads shall be inspected by the Contractor after each cast and repaired or replaced if worn or damaged except that bulkheads for deck panels that may be placed to provide the minimum strand projection.

Wood forms shall be sealed with a material to prevent absorption. The sealer shall be applied and cured in accordance with the manufacturer's recommendations.

Forms shall be cleaned of adherent material before each use. Forms shall be cleaned of all foreign matter and debris immediately prior to placing concrete. New forms shall be free from paint or other protective coatings.

Forms shall be treated with a non-staining bond breaking compound applied in accordance with the manufacturer's recommendations.

If the reinforcing steel or strand has been contaminated with the bond-breaking compound, it shall be cleaned with solvent. No concrete shall be placed until the reinforcing steel and strand has been inspected and accepted by the QCI.

535.11 Reinforcing Steel Reinforcing steel shall be fabricated, packaged, handled, stored, placed, spliced, and repaired in accordance with Section 503 - Reinforcing Steel.

Reinforcing steel shall be accurately located and securely anchored to prevent displacement during concrete placement. All reinforcing steel shall be installed and secured before beginning the concrete placement.

The concrete cover shown on the approved shop drawings shall be the minimum allowable cover. The contractor shall use bar supports and spacers to maintain the minimum concrete cover. The bar supports and spacers shall be made of a dielectric material or other material approved by the Fabrication Engineer.

535.12 Voids and Inserts Voids shall be non-absorbent. The out-to-out dimensions of the voids shall be within 2% of plan dimensions. Damaged voids shall be repaired in manner acceptable to the QAI. Voids shall be stored, handled and placed in a manner that prevents damage. Residue from void placement shall be entirely removed from the forms before beginning or continuing the concrete placement.

Voids shall be located accurately, anchored securely, capped and vented. Any portion of a void that is displaced beyond the allowable dimensional tolerances shall be cause for rejection of the slab or beam.

Cast in place threaded inserts shown on the plans shall be accurately located and securely fastened. Inserts installed to erect forms in the field shall be recessed a minimum of 25 mm [1 in]. Holes that penetrate through the thickness of a member will not be permitted.

535.13 Concrete Concrete mix designs shall be submitted to the Fabrication Engineer for approval a minimum of 30 days prior to beginning work. Mix designs previously approved for use shall not require qualification by trial batch if the mix design meets all the requirements of this Section.

New concrete mix designs shall be qualified by trial batches prepared in accordance with AASHTO T126 (ASTM C192). The test results shall demonstrate that the concrete meets the requirements of the Plans and this Section. If accelerated curing is to be used in production, the test specimens shall be similarly cured.

No concrete shall be placed until the mix design has been approved. Approval of the mix design does not relieve the Contractor of the responsibility of meeting the requirements of this Section during production.

The concrete mix design shall meet the following requirements:

Table 1

Minimum cement content	400 kg/m ³ [658 lb/yd ³]
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Water-cement ratio	0.40 maximum
Air entrainment	5½ % - 7½ %
Allowable slump	125 mm to 255 mm [5 in to 10 in]
Calcium Nitrite*	14.85 L/m ³ [3 gal/yd ³]
Silica Fume (when required)	5% - 10% of cement content by weight
Fly Ash	40% of cementitious material maximum
Slag	50% of cementitious material maximum

*The water in the Calcium Nitrite solution shall be included when calculating the water/cement ratio

The concrete mix design shall be proportioned such that the concrete achieves transfer strength within twenty-four hours of the completion of the placement. If two consecutive placements fail to meet the above requirement, no further placements shall take place until corrective action is taken by the Contractor.

The batching equipment, mixers and delivery equipment shall meet the requirements of MNL 116. Concrete shall be batched, mixed and handled in accordance with MNL 116.

535.14 Concrete Placement The first two loads of concrete from each placement shall be tested by the QCI for temperature, air entrainment, and slump. If the first load is unacceptable, the second load shall be tested as the first. This process shall continue until two consecutive loads are found acceptable. After two consecutive loads are found acceptable, the frequency of testing shall be at the discretion of the QAI.

Concrete shall be tested if there is a change in the dosage rate of any admixture, a change of 50 mm [2 in] or more in slump or a change of more than 3°C [5°F] in mix temperature.

Any load of ¾ m³ [1 yd³] or less from a stationary mixer or 1½ m³ [2 yd³] or less from a transit mixer shall be tested for air entrainment, slump, and temperature prior to being placed in the form.

Concrete shall be placed as nearly as possible to its final location. The depth of a lift shall be controlled in order to minimize entrapped air voids. The maximum depth of an unconsolidated lift shall be 450 mm [18 in]. Concrete shall be vibrated with internal or internal and external vibrators. External vibrators shall not be used alone. Internal vibrators shall be inserted vertically and penetrate the lower layer of concrete by at least 100 mm [4 in]. The vibrators shall be inserted to assure that the radii of action of the vibrators overlap. The vibrators shall be held in position from 5 to 15 seconds.

Vibrators shall not be used to move concrete horizontally.

When concrete placements are interrupted (e.g. placing voids in box beams), no more than 60 minutes shall elapse from the time of the beginning of the placement and the resumption of the concrete placement when the concrete temperature is below 24°C [75°F]. When the concrete temperature is above 24°C [75°F], the elapsed time shall be reduced to 30 minutes. Cold joints may make the unit subject to rejection.

No water shall be added to the concrete after batching. HRWR may be added to the concrete after batching if that practice conforms to the manufacturer's published recommendations. Concrete that becomes unworkable shall be discarded.

535.15 Process Control Test Cylinders All process control test cylinders shall be made and tested in accordance with the following Standards:

AASHTO T23 (ASTM C31/C31M) Practice for Making and Curing Concrete Test Specimens in Field

AASHTO T22 (ASTM C39) Test Method for Compressive Strength of Cylindrical Concrete Specimens

AASHTO T119 (ASTM C143) Test Method for Slump of Hydraulic Cement Concrete

AASHTO T141 (ASTM C172) Practice for Sampling Freshly Mixed Concrete

AASHTO T152 (ASTM C231) Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C1064 - Test Method for Temperature of Freshly mixed Portland Cement Concrete

A minimum of 8 concrete test cylinders shall be cast to represent each continuous concrete placement except that, 8 concrete test cylinders shall be made for each bulb "T" girder cast in a continuous placement. Six of the cylinders from each test shall be cured under the same conditions as the units. Unit identification, entrained air content, water-cement ratio, slump and temperature of the sampled concrete shall be recorded by the Contractor at the time of cylinder casting. Testing shall be done in the presence of the QAI. The QAI will designate the loads to be tested. Cylinders made to determine transfer strength shall be made during the last 1/3 of the placement.

At least once a week, the Contractor shall make four cylinders for use by the Department. They shall be cured in accordance with AASHTO T23 (ASTM C31/C31M).

If the Contractor fails to make enough cylinders to demonstrate that the product meets the contract requirements, the product will be considered unacceptable.

The standard size test cylinder for acceptance shall be 150 mm by 300 mm [6 in by 12 in]. If 100 mm by 200 mm [4 in by 8 in] cylinders are used for acceptance, the compressive strength values shall be reduced by 5%. The compressive strength of the concrete shall be determined by averaging the compressive strength of two test cylinders made from the same load.

For the purpose of detensioning prestressed products, neither of the test cylinders shall have a compressive strength less than the minimum required transfer strength after the 5% reduction 100 mm by 200 mm [4 in by 8 in] cylinders is taken.

For the purpose of acceptance, the average of two cylinders shall meet or exceed the design strength, and, neither cylinder shall be more than 3.5 MPa [500 psi.] below the required strength.

Compressive testing to determine transfer and design strength shall be done in the presence of the QAI. Cylinder tests not witnessed by the QAI will not be acceptable.

535.16 Curing Immediately after the concrete has been finished, the product shall be covered with an impermeable barrier to prevent moisture loss. The barrier shall be tight to the form and securely fastened. The exposed surface of the concrete shall be kept moist. The Contractor shall monitor and record the concrete temperature during the initial curing cycle.

After the product has been removed from the form, moist curing shall continue until it has reached design strength. All surfaces of the product shall be kept moist and the product shall be placed in a moisture retention enclosure with a relative humidity not less than 80%. The product shall not be exposed to temperatures below 10°C [50°F] until design strength is achieved.

Membrane curing compounds shall not be used without the approval of the Fabrication Engineer. If approved, the compound shall be applied in strict accordance with the manufacturer's published instructions. The Contractor shall provide the QAI with the product data sheet for the compound prior to application. The compound shall be applied immediately after stripping.

535.17 Accelerated Curing (Optional) Accelerated curing shall begin after the concrete has attained its initial set. Initial set shall be determined in accordance with ASTM C403, Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance. A strength gain of 3.5 MPa [500 psi.] indicates initial set. The Contractor shall provide documentation that the mix design being used has been tested in accordance with ASTM C403. Accelerated curing shall begin after the concrete has attained initial set. Application of heat more than 8 hours after initial set will not be

considered accelerated curing.

The enclosure temperature may be increased by a maximum of 5.6°C/hr. [10°F/hour] prior to initial set. The total temperature gain prior to initial set shall not exceed 22°C [40°F].

After initial set, the temperature gain of the concrete shall not exceed 22°C/hr. [40°F/hour]. The concrete temperature shall attain a minimum temperature of 50°C [120°F] and that temperature shall be maintained for a minimum of 8 hours. The maximum allowable concrete temperature shall be 82°C [180°F]. Concrete temperature shall be measured near each end of the casting bed and at intervals not to exceed 30 m [100 ft].

The cooling rate from maximum accelerated curing temperature shall not exceed 22°C/hour [40°F/hour]. The cooling rate shall continue until the concrete temperature is within 22°C [40°F] of the ambient air temperature.

Steam curing shall take place in an enclosure that allows the free circulation of steam. Steam jets shall provide a uniform distribution of steam without discharging directly on the product or the test cylinders.

When radiant heat is used, the Contractor shall take measures to assure that there is no moisture loss from the product. Free water shall be present on all exposed surfaces at all times.

Recording thermometers that indicate the time/temperature relationship shall be used by the Contractor until transfer/stripping strength has been achieved. Copies of the time/temperature records shall be made available to the QAI.

If the units have achieved 80% of design strength during the curing cycle, no further curing will be required.

535.18 Prestressing The Contractor shall provide stressing calculations to the QAI before tensioning strands. Application of initial force and final tensioning shall be performed in the presence of the QAI. The QCI shall be present to witness and document the application of initial force, final tensioning and elongation of the strand.

Measurement of tensioning force shall be accomplished by one of the following:

- a. Pressure gauges measuring hydraulic pressure

- b. Dynamometer
- c. Load cell-digital readout
- d. Digital readout connected to a transducer measuring hydraulic pressure

Equipment used to measure tensioning force shall be calibrated within 6 months of the beginning of the project. Calibration shall be performed by an approved testing laboratory, calibration service or under the direct supervision of a Professional Engineer registered in the State of Maine. Calibration shall be done in accordance with the manufacturer's recommendations.

The Contractor shall provide a Calibration Report for the tensioning device being used. The Calibration Report shall include a Calibration Conversion Chart that correlates gauge readings with actual force applied. The gauge reading used in production shall be interpolated using the gauge-force reading closest to the required force derived from the stressing calculations.

Equipment used to measure tensioning force shall be graduated to read within $\pm 2\%$ of the anticipated force. Rams, gauges, pumps and hoses shall be calibrated together as a system. Replacement of any of the previously listed components shall require re-calibration of the jacking system. If the same device is used for initial and final tensioning, separate gauges shall be installed in the system. Both initial force and final tensioning hydraulic gauges shall be at least 150 mm [6 inches] in diameter and shall be graduated such that the anticipated force falls within the middle third of the gauge range. Gauges shall be at or near eye level and the needles shall remain steady until the load is released.

Strands shall be pulled in an orderly sequence to avoid snags and entanglements. When strands from two or more coils or reel-less packs are used, the strands shall be identified by lot number. Elongation and adjusted gauge pressure readings shall be calculated for each modulus of elasticity and cross sectional area of the strands.

Prior to tensioning, hydraulic jacking devices shall be run until the hydraulic fluid is brought up to normal operating temperature. The jack shall be cycled several times to assure that the fluid in the lines is also at operating temperature.

Initial tensioning shall be done in the reverse order from that which the strand was pulled to avoid friction and dead load losses due to overlying strand. After all strands have been initially tensioned, final tensioning shall begin. As an alternative, if the Contractor demonstrates that each strand is free of potential friction and dead load losses prior to reaching initial tension, the final tensioning force may be applied to the strand at that time. The Contractor shall visually inspect each strand during initial tensioning to assure that the strand is free of overlying strands or reinforcing steel.

After initial tensioning, the Contractor shall establish a permanent and clearly visible reference mark on the strand to determine strand elongation after final tensioning. Strand elongation shall be measured to the nearest 2 mm [$\frac{1}{16}$ in]. The gauge pressure reading and strand elongation shall be within 5% of theoretical. The algebraic difference between the error in gauge reading and elongation shall not exceed 5%. If the elongation, gauge reading or the algebraic difference exceeds 5%, the tensioning operation shall be suspended until the Contractor determines the cause and makes corrections.

535.19 Detensioning Detensioning shall be carried out in the presence of the QAI and QCI.

At the beginning of every job, the strands of each unit shall be marked and strand slippage shall be measured and recorded by the QCI. The QAI may require that the strand slippage be measured on any unit if the QAI has reason to question the concrete consolidation around the strand.

Forms or any devices that restrict horizontal or vertical movement of the units shall be loosened or removed before detensioning. The Contractor shall take measures to prevent damage, spalling or cracking, to the members that may be caused by detensioning.

Detensioning shall be performed in the sequence shown on the approved drawings. Failure to follow this sequence shall be cause for rejection of the product.

Detensioning shall be done as soon as it is practical after the units have achieved transfer strength. If accelerated curing was used, detensioning shall be performed immediately following the curing period while the concrete is still warm and moist.

If detensioning is accomplished by single strand release, each strand shall be cut by heating gradually with a low oxygen flame at both ends of the pre-stressing bed and at all intermediate points, in multiple unit casts, simultaneously. A minimum length of 150 mm [6 in] of strand shall be heated to prevent any shock or snap when the strand is finally severed. When possible, the strand should be cut a minimum of 450 mm [18 in] from the bulkhead of the form.

If detensioning is accomplished by multiple strand release, the equipment shall be capable of releasing the load gradually, without shock, and with a minimum of movement of the units.

535.20 Finishing Concrete and Repairing Defects Products fabricated under this Section shall meet Standard Grade finish requirements as defined in MNL 116. The recommendations of Standard Grade finish requirements shall be mandatory. Fascia beams shall meet the requirements of finish Grade A.

Honeycombing, ragged or irregular edges and other cosmetic defects shall be repaired using a product from the MDOT Prequalified List for Patching Materials. The repair, including preparation of the repair area, mixing, application and curing of the patching material shall be in accordance with the manufacturer's published instructions. Edges not exposed in the final product may be ground smooth with no further repair necessary if the depth of the defect does not exceed 12 mm [$\frac{1}{2}$ in]. Form ties shall be removed to a depth of not less than 25 mm [1 in] from the face of the concrete and patched by a method approved by the Fabrication Engineer.

Structural defects shall be repaired by a method approved by the Fabrication Engineer. Structural defects shall include, but not be limited to exposed reinforcing steel or strand, cracks in bearing areas, through cracks and cracks 0.3 mm [0.013 in] in width that extend more than 300 mm [12 in]. The Contractor shall submit a proposed repair procedure for structural repairs to the Fabrication Engineer. No structural repairs shall be made without the QAI being present. The QAI shall be given adequate notice before beginning repairs.

Chamfers and drip notches shall be made smooth and uniform. Keyways shall be sandblasted to remove mortar paste. Ends of strands shall be recessed 25 mm [1 in] and shall be patched and coated with a bituminous protective coating or, if exposed, sacked to a uniform finish.

535.21 Precast Deck Panels Precast deck panels shall be produced in accordance with the plans and Standard Details, PRECAST CONCRETE DECK PANELS. Temporary supports for precast deck panels shall consist of continuous high-density expanded polystyrene strips. As an alternative, non-corrosive embedded inserts, threaded leveling jacks and compressible foam seals or other sealing devices may be used to support the precast deck panels.

535.22 Tolerances Tolerances for precast units shall be in conformance with the latest edition of MNL 116, as applicable. Voided slabs shall be manufactured to the following tolerances:

Precast, Prestressed Voided Slabs	
Depth of Slab	+/- 6 mm [+/- $\frac{1}{4}$ in]

Width of Slab	+/- 6 mm [+/- ¼ in]
Length of Slab	+/- 3 mm /3 m [+/- • in/10 ft] of length or 13 mm [½ in], whichever is greater
Skewed Ends	+/- 6 mm [+/- ¼ in](deviation from required skew)
Beam Seat Bearing Area	+/- 2 mm [+/- 1/16 in]
Horizontal Alignment	+/- 6 mm [+/- ¼ in] (deviation from straight line parallel to centerline of member)
Dowel Tubes	+/- 6 mm { +/- ¼ in] (center of tubes to sides of member)
Void Tubes	+/- 6 mm [+/- ¼ in] (vertically and horizontally) or +/- 13 mm [+/- ½ inch] (location of ends)
Post Tension Ducts	+/- 6 mm [+/- ¼ in]
Differential camber between Adjacent Units	+/- 3 mm /3 m [+/- • in/10 ft] of length or 13 mm [½ inch] maximum
Center of Gravity of Strand Group	+/- 6 mm [+/- ¼ in]
Stirrup Bars	+/- 13 mm [+/- ½ in] projection above top of beam or +/- 25 mm [+/- 1 in] longitudinal spacing

535.23 Transportation and Storage After the prestressed products are detensioned, they may be handled and moved, but shall not be transported until the 28 day design strength has been attained.

Prestressed products shall be transported so that the reactions with respect to the unit shall be approximately the same during transportation and storage as the product in its final position. The product shall be handled so that only a vertical force is applied to the lifting devices.

Stored products shall be supported above the ground on dunnage in a manner to prevent twisting or distortion. Products shall be protected from discoloration and aesthetic damage.

Units damaged by improper storing, hoisting or handling shall be replaced by the Contractor.

535.24 Bearings When longitudinal keys are to be grouted, the post-tensioning strand shall be tensioned to 22 kN [5 kips]. Prestressed units shall not be placed upon bearing areas that are improperly finished. Bearing shall be installed in conformance with Section 523 - Bearings. Elastomer sheets (non-laminated bearing pads) shall be installed as shown on the plans.

535.25 Keyway Grout Longitudinal keyways between beams shall be filled with a non-shrink, flowable, cementitious grout with a design compressive strength of 42 MPa [6000 psi.]. The grout shall be one of the products listed on the Maine Department of Transportation's list of Pre-qualified Grout Materials for Keyways. The grout shall be mixed, placed and cured in accordance with the manufacturer's published recommendations. Gaskets of compressible material are required around duct openings within keyways to prevent blocking of the duct with grout.

Immediately before filling the keyway, it shall be cleared of debris. The keyway surfaces shall be soaked with water prior to placement of grout. The keyways shall be sealed to prevent material loss.

535.26 Lateral Post-Tensioning A final tension of 129,000 N [29,000 lb] per strand shall be applied to lateral post-tensioning strands.

After tensioning, the ends of the strands shall be sawn or abrasion cut not less than 32 mm [1¼ in] from the end of the wedge. The tendon tail and the gripping part of the anchorage shall be coated with a corrosion inhibiting grease and then capped with a watertight covering. The entire anchorage shall be watertight.

Recesses at ends of lateral post-tensioning ducts shall be filled with grout using the same type cement as that in the prestressed slabs. Prior to installing the grout, the stressing pockets shall be clean of any dirt, grease, oil, or other material that may prevent bonding. Grouting shall be completed within 10 days of lateral post-tensioning. No vehicular traffic, including the Contractor's equipment shall be allowed on the bridge until post-tensioning is complete.

535.27 Erection of Precast Deck Panels Precast deck panels shall be erected as shown on the plans. Foam temporary supports shall be attached to the outside edges of the top flanges of the girders with an adhesive applied in accordance with the manufacturer's published recommendations. The foam shall be field-cut to adjust the bottom-of-slab elevations as required. If threaded jacking devices are cast into the panels, the bottom-of-slab elevations shall be adjusted with the jacks.

After the precast deck panels have been erected, adjusted and sealed, the void between the top of the girder flange and the

bottom of the panels shall be filled with a non-shrink, flowable, cementitious grout with a design compressive strength of 42 MPa [6000 psi.]. The grout shall be one of the products listed on the Maine Department of Transportation's list of Pre-qualified Grout Materials for Keyways. The grout shall be mixed, placed and cured in accordance with the manufacturer's published recommendations. Vent holes shall be provided at 1 m [3 ft] intervals to prevent air lock.

Before placing cast-in-place concrete on the precast deck panels, the joints shall be caulked to prevent seepage of concrete paste.

Oil, grease and other contaminants that may prevent a bond between the precast deck panels and the cast-in-place concrete shall be removed by abrasive blast cleaning.

535.28 Method of Measurement Prestressed structural concrete will be measured by the lump sum.

535.29 Basis of Payment All work done under Prestressed Structural Concrete will be paid for at the contract lump sum price. Payment will be full compensation for furnishing all materials in the precast/pre-stressed unit including anchor dowels, reinforcing steel, and related materials and work. Related materials and work will include, but not be limited to, preformed pads, erecting the products, drilling and grouting of anchor dowels, grouting of keyways and ducts, post-tensioning operations and concrete admixtures used.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
535.60 Prestressed Structural Concrete Slab	Lump Sum
535.61 Prestressed Structural Concrete I-Girders	Lump Sum
535.62 Prestressed Structural Concrete Box Beams	Lump Sum